Chapter 4

Introduction to the Meade LX-10 8″ Schmidt-Cassegrain Telescope

4.1 Purpose

In this lab, we will learn about the operation of the Meade LX-10 telescope and your planisphere. It is much easier to learn the operation of the telescope in a classroom than on the Small Hall observation deck at night. What you learn in this afternoon lab will be used extensively during the evening observations with the telescopes.

4.2 Introduction

In this lab course, you will be using a Meade LX-10 telescope to make observations of celestial objects. The LX-10 is of Schmidt-Cassegrain design, and uses an 8-inch mirror in the base of the telescope to collect and focus the light.

What does the 'Schmidt-Cassegrain' name mean?

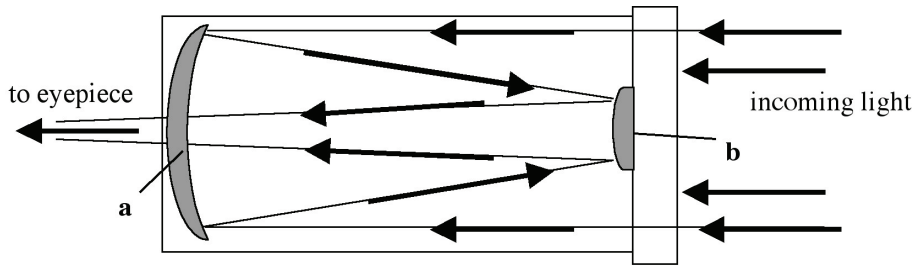

Figure 4.1: The Schmidt-Cassegrain Telescope.

Schmidt-Cassegrains use a *spherical primary mirror* **(a)** to focus incoming light onto a *convex secondary mirror* **(b)**, which sends the light back through a hole in the primary mirror to

the eyepiece, located at the rear of the telescope. Spherical mirrors are less expensive to make than parabolic mirrors but introduce *spherical aberration* (*i.e.* the stars will look like fuzzy dots instead of zero-dimensional points). By using an 8-inch *correcting plate* (lens) at the front of the telescope, spherical aberration can be corrected.

To aid in familiarizing you with the night sky, a *planisphere*, or sky wheel, is included with your lab kit. A planisphere can be used all year long at anytime of the night (or day) to show which stars are presently visible. Their only limitation is that they are constructed to correspond to a particular latitude range.

4.3 Procedure

4.3.1 Important Things to Remember about the Telescope

1. Never force anything. All knobs and moveable parts should move easily. **Do not force** pieces that should be moving but aren't. If something doesn't work correctly it is either broken or you need some assistance.
2. Please **do not touch any optical surface for any reason**. If they are smudged, please leave the cleaning to the TAs. Fingerprints are very difficult to remove. Also, please remove eye make-up before using.
3. Please treat the telescope with respect and care.
4. **Do not** unscrew lenses or mirrors!!! If you unscrew the secondary, the telescope will never be the same again.
5. **Never use the telescope to look at the Sun**. Looking at or near the Sun will cause instant and irreversible damage to your eye.

First, your teaching assistant will explain the components and controls of the telescope. Your teaching assistant will also demonstrate how to properly use the telescope so the telescope is not damaged.

After your teaching assistant has explained the working of the telescope, small groups will be ask to identify the components and controls of the telescope. You may be ask to identify the three eyepieces and demonstrate how to properly change eyepieces.

Please take some time to review the major parts of the telescope. The major parts are noted on the figures on the following pages. Remember, you will need to be able to do this in the darkness when doing the outside observations with the telescope.

4.3.2 Parts of the Telescope

1. The *eyepiece* where the different eyepiece lenses are inserted; where you look into.

2. The *focus knob*.
3. The *RA and Dec lock clamps*. NEVER try to physically move the telescope when these are locked. You will irreversibly damage the gearing.
4. The *Declination Slow Motion Control Knob*. You may turn this when the clamp is locked to fine-tune the declination.
5. The *RA Slow Motion Control Knob*. NEVER TURN THIS WHEN THE RA CLAMP IS FULLY LOCKED, REGARDLESS OF WHETHER OR NOT THE TELESCOPE DRIVE IS ON. You will damage the gears.
6. The *Dec and RA Setting Circles*. These can be used to find faint objects.
7. The *Keypad Hand Controller* — Only the W–E buttons work. These are used to fine-tune placement of the object in the RA direction only. Not always used.
8. The *Power Panel*. This is where you turn on the telescope tracking motor.
9. The *Polar Axis*. The telescope will be pointed along this axis when you first align the telescope.
10. The *Manual Knob for Polar Alignment* — ONLY LOOSEN SLIGHTLY when aligning.

4.3.3 Focusing the Meade Telescope

One or two telescopes will be set up in the hallway. In small groups, you will be ask to align the telescope on a small target at the other end of the the hall and focus the image of the target.

Record the orientation of the image below:

Image upside down or right side up? _____

Image left-right normal or inverted? _____

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WARNING!

Never use the LX10 telescope to look at the Sun! Looking at or near the Sun will cause *instant* and *irreversible* damage to your eye. Eye damage is often painless, so there is no warning to the observer that damage has occurred until it is too late. Do not point the telescope or its viewfinder at or near the Sun. Do not look through the telescope or its viewfinder as it is moving. Children should always have adult supervision while observing.

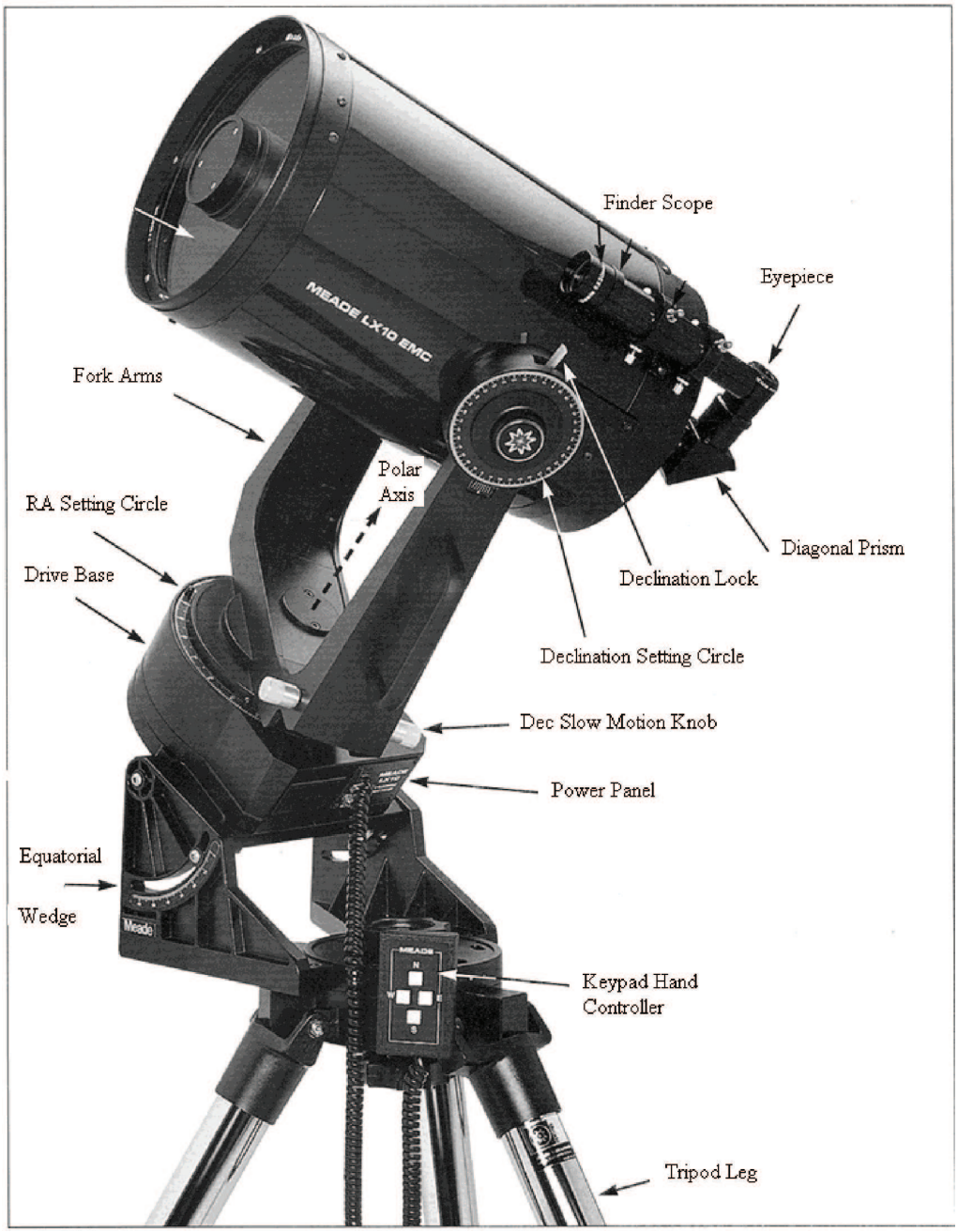
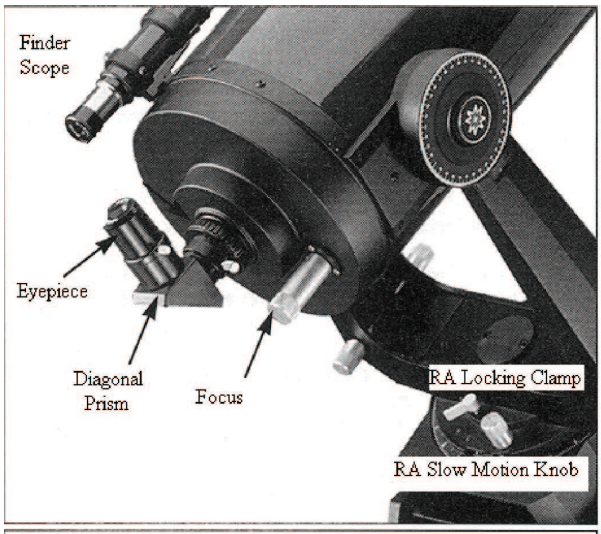
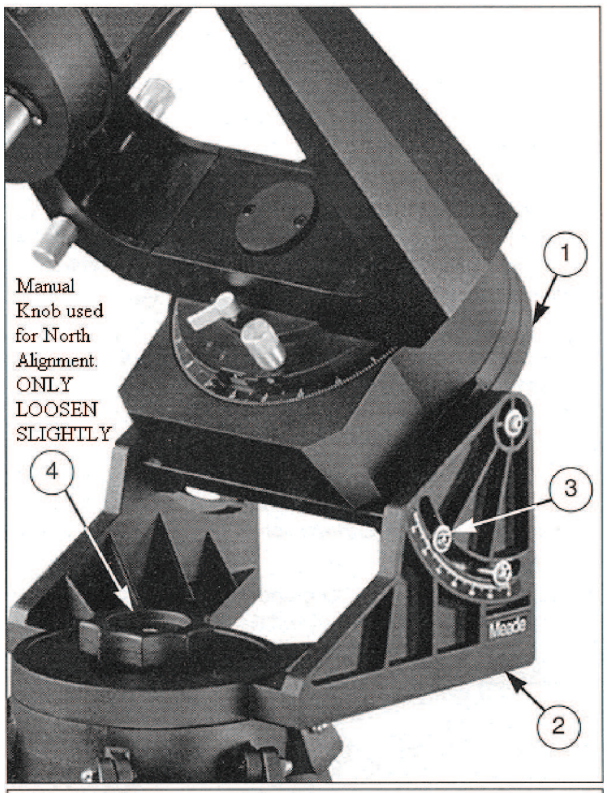


Figure 4.2: The Meade 8" LX-10 Schmidt-Cassegrain Telescope



(1) Eyepiece holder; (2) Eyepiece; (3) Diagonal Prism;
(4) Focus knob.

Figure 4.3: Eyepiece and Focus Knob



The Equatorial Wedge. (1) Tilt plate; (2) Wedge body;
(3) Tilt angle adjustment lock; (4) 3" manual knob.

Figure 4.4: The Equatorial Wedge

4.3.4 How to Use a Planisphere

1. Note the date and time (if the clocks are set for daylight savings time, deduct an hour from your clock time).

2. On the sky wheel, turn the wheel until it matches your time and date. The elliptical-shaped opening shows the visible stars.

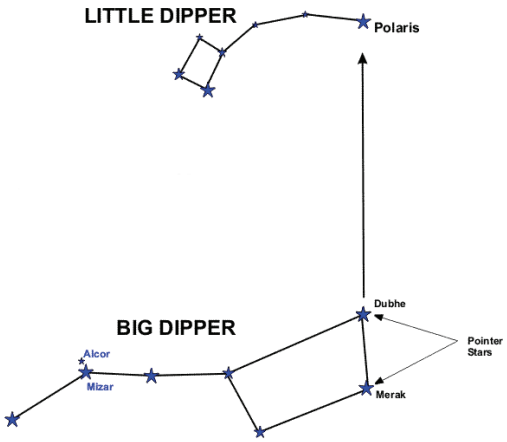


Figure 4.5: Finding Polaris

3. Find North. Hold the planisphere such that North is at the bottom. The hole in the center marks the location of Polaris, the North star. (To find Polaris in the sky at night, first locate the Big Dipper. The two stars at the end of the 'spoon' point to Polaris. Refer to Figure 4.5.)

4. The planisphere is a projection of the night sky. Hold the planisphere up; it should correspond to what the sky looks like. The stars directly overhead will be found in the center of the map and those to the north will be at the bottom. The reverse side of the planisphere shows the stars to the south. Always hold the planisphere so that the direction you are facing is at the bottom. Alternatively, you may find that it is easier to use the chart when lying down.

Notice how the planisphere marks the celestial coordinates. Declination is shown as a series of concentric circles, with 90° being in the center. RA is shown as a series of spokes, radiating from the center. Recall how we can use RA to determine at what time a star will be directly overhead.

These small charts can be misleading in several respects. This is not due to any flaw in their design; it is simply due to the fact that they are trying to capture a large hemisphere of the sky and represent it on a small flat circle. Firstly, the angular scale of objects in the sky is much larger than on the map. The hardest part in using such a chart is making the transfer from a small area on the map to a large area on the sky. You can see the entire chart at once but you cannot see the entire sky at once.

Secondly, the relative brightness of stars cannot be represented properly on a printed map. Remember that a star that is bigger on the map will appear brighter in the sky, but not bigger than the other stars. Finally, there will be distortion in the map due to its projection on a flat surface. This is identical to the type of distortion one gets when trying to represent the surface of the Earth on a flat map. The problem is particularly severe around the edges of the chart. Note that on the back of the planisphere—there is another chart which shows the constellations low in the southern sky around the celestial equator with less distortion.